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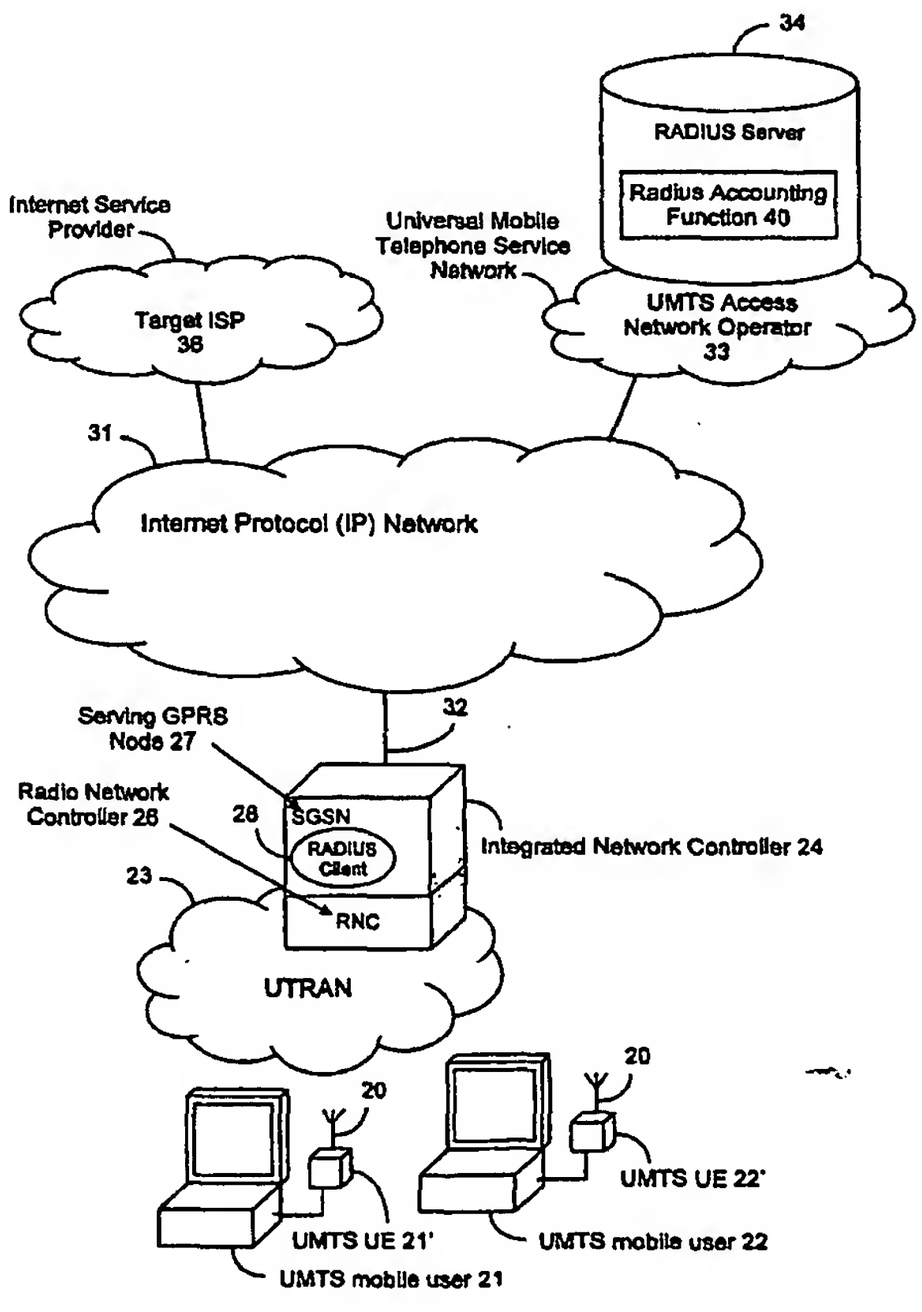
(54) Title: USE OF RADIUS IN UMTS TO PERFORM ACCOUNTING FUNCTIONS

(57) Abstract: Internet web technology is used, and specifically a RADIUS (Remote Access Dial-In User System) server is used to keep records of connection time, data transmitted, session time and disconnection in a wireless access system.



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USE OF RADIUS IN UMTS TO PERFORM ACCOUNTING FUNCTIONS

RELATED APPLICATIONS

U.S. patent application Serial No. 09/626,699, filed July 27, 2000, entitled "USE OF INTERNET WEB TECHNOLOGY TO REGISTER WIRELESS ACCESS CUSTOMERS," and U.S. patent application Serial No. 09/626,700, filed July 27, 2000, entitled "USE OF RADIUS IN UMTS TO PERFORM HLR FUNCTION AND FOR ROAMING," which are continuations-in-part of U.S. patent application Serial No. 09/432,824, filed November 2, 1999, entitled "CELLULAR WIRELESS INTERNET ACCESS SYSTEM USING SPREAD SPECTRUM AND INTERNET PROTOCOL (IP)", and published in equivalent form as European patent publication EP1098539.

INTRODUCTION

The present invention is directed to the use of the Internet web technology to perform accounting functions in a wireless Internet access network.

BACKGROUND OF THE INVENTION

As disclosed in application Serial No. 09/432,824 of November 2, 199 entitled CELLULAR WIRE INTERNET ACCESS SYSTEM USING SPREAD SPECTRUM AND INTERNET PROTOCOL (IP), this describes a cellular wireless Internet access system

which operates in the 2 gigahertz or other frequency bands to provide high data rates to fixed and portable wireless Internet devices. Such users connect to near-by base stations which in turn communicate to Integrated Network Controllers which are then connected to the Internet. Such wireless implementation relates to an access network of the UMTS (Universal Mobile Telephone Service) type and its subset UTRAN (Universal Terrestrial Radio Access Network) standards. UMTS/UTRAN standards are published by the 3G Project Partnership (3GPP), www.3gpp.org.

In any telecommunication access system, be it wired or wireless, there must be some type of centralized accounting for recording customer's usage and for billing purposes. Where the access to the Internet is via the Public Switched Telephone Network (PSTN), a RADIUS system supports such accounting function. A description of RADIUS is provided by an article, RFC2138 Remote Authentication Dial-In User Service (RADIUS) by C. Rigney, et al., April 1997, which is available at the website www.ietf.org. Thus far, this system, however, has only been used for a Public Switched Telephone Network access.

Traditional mobile communications technology generating accounting information for Internet service may not satisfactorily support all aspects of the wireless access system describe in the above co-pending application 09/432,824.

There is therefore a need for allowing performance of accounting functions in a wireless access system in which the above disadvantages may be alleviated.

SUMMARY OF INVENTION

In accordance with a first aspect of the invention there is provided a method of operation in a wireless access network system, as claimed in claim 1.

In accordance with a second aspect of the invention there is provided a wireless access network system, as claimed in claim 10.

In accordance with a third aspect of the invention there is provided a RADIUS arrangement for use in a wireless access network system, as claimed in claim 19.

In accordance with a fourth aspect of the invention there is provided a network controller for use in a wireless access network system, as claimed in claim 21.

In accordance with a fifth aspect of the invention there is provided a computer program element comprising computer program means for performing the method of operation in a wireless access network system, as claimed in claim 22.

In a preferred form of the invention, there is provided a method of operating a cellular wireless Internet access

system using RADIUS (Remote Authentication Dial-In User Service) which is normally used for authentication and accounting for dial-up Internet access over the PSTN (Public Switched Telephone Network) where the user utilizes a portable subscriber terminal with a directly attached antenna for communicating in a wireless manner via a cellular network with an integrated network controller and then to a target Internet Service Provider (ISP), comprising the steps in conjunction with a wireless Internet access network operator providing a RADIUS accounting function within its RADIUS server. A subscriber terminal is linked via a wireless network to an Integrated Network Controller for negotiating access with a RADIUS server. If a confirmation of access is approved by the RADIUS server, the subscriber is permitted to connect to the Internet and the radius accounting function in the RADIUS server tracks the connect time of the subscriber terminal to the network, volume of data transmitted, a record of connection of the subscriber terminal, and other details relating to the subscriber session in an accounting data base connected with said RADIUS server. Disconnection is recorded when the subscriber terminal disconnects from the wireless network.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an Internet system illustrating the present invention.

FIGS. 2 is a diagram illustrating the method of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to FIG. 1, two typical users of the Internet access system are illustrated at 21 and 22. Each wireless access user has a personal computer PC and UMTS user equipment (UE) 21' and 22' with a directly attached antenna 20 is connected by typical data connection such as an RS232, USB or Internet to the PC. The user equipment is termed a portable subscriber terminal, operating in conjunction with its associated PC.

The wireless access user is described in the above co-pending application as a part of a UMTS/UTRAN system, the technique being described in the above co-pending application, which communicates in a wireless manner, via a UTRAN network 23, to an integrated network controller (INC) 24. Such controller may be connected by wire or otherwise to an Internet system or web 31. As discussed in the above co-pending application, the controller 24 includes an RNC or Radio Network Controller 26, which controls and allocates the radio network resources and provides reliable delivery of user traffic between a base station and subscriber terminal. An SGSN (Serving General Packet Radio Service Node) 27 provides session control. Lastly, a RADIUS element designated RADIUS client 28 is incorporated to provide authentication and

accounting. The Internet protocol network 31 is connected to INC 24 by an Internet protocol connection 32 and then to a UMTS access network operator 33 having a RADIUS server 34 incorporating an accounting function 40. There is also a designated target ISP 36. From an overall viewpoint, the RADIUS accounting function 40, which supports wireless access network accounting, replaces the conventional accounting functions and associated protocols as normally used on cellular mobile networks based on the UMTS/UTRAN standards.

Once a user has established an access network session, accounting information related to that session is recorded by the RADIUS client 28 within the SGSN 27. Per session accounting information comprises information on connect time, volume of data sent and received by the mobile user, and also other information relating to the subscriber and the ISP to which he is connected. This information is sent to the RADIUS accounting function 40 within the RADIUS server 34 using standard RADIUS accounting messages.

It will, of course, be appreciated that the accounting functions discussed above will typically be carried out in computer programs or routines in software (like other system functions) running on processors (not shown).

FIG. 2 illustrates the above which shows the communication between the RADIUS client 28 in the SGSN 27 and the RADIUS accounting function 40. In the initial authentication sequence 41, RADIUS client 28 negotiates

access for the subscriber 21 or 22 with the RADIUS server 34 as indicated by the arrow 42. If there is confirmation of access and tier of service indicated by arrow 43, the RADIUS server then at step 44 tracks the connect time for the user from this point. Then an accounting request in step 45, as shown by the arrow 46, is sent from the RADIUS client 28 to the RADIUS accounting function 40 and the RADIUS accounting function keeps records of data transmitted and other necessary information in its accounting database and there is a response as shown by arrow 47. This may occur at repeated intervals 46', 46", 47' and 47" until a disconnect occurs as shown at step 48. Here the RADIUS server shown at step 49 keeps the disconnection record together with all other information gathered in the subscriber's session in its accounting database; thus, all of the necessary accounting functions are provided. Such accounting messages are forwarded to the RADIUS accounting function 40 at configurable intervals; the normal facilities of the RADIUS protocol for insuring reliable delivery are used. Thus this generates accounting records while the session is in progress and inherently is able to account for potentially very long duration Internet connection sessions while the sessions are in progress rather than (as opposed to the previous system) only after they are concluded. This is analogous to long duration call records in telephone system billing records. When a session is terminated, a final accounting message is sent to the RADIUS server to report the total connect time and total data sent and received for that wireless access network session. Accounting

records thus generated are subsequently fed into a billing system to be reconciled and user billing produced.

Thus an improved accounting system for a wireless network has been provided.

WHAT IS CLAIMED IS:

1. A method of operation in a wireless access network system, comprising the steps of:

(a) providing a RADIUS arrangement with an associated RADIUS accounting function;

(b) a user accessing the network via wireless user equipment and via the RADIUS arrangement; and

(c) the RADIUS arrangement tracking access activity by the user and recording such activity in an accounting database associated with the RADIUS accounting function.

2. The method of claim 1, wherein the RADIUS arrangement tracks the user's connection time.

3. The method of claim 1, wherein the RADIUS arrangement tracks the user's volume of data transmitted.

4. The method of claim 1, 2 or 3, wherein the accounting database is updated upon user disconnection.

5. The method of any preceding claim wherein the accounting database is updated at predetermined intervals of time to thereby accommodate long duration connection sessions.

6. The method of any preceding claim wherein the wherein the RADIUS arrangement receives information from a network controller of the system.

7. The method of claim 6 wherein the RADIUS arrangement comprises a RADIUS client at the network controller.

8. The method of any preceding claim wherein the system is a cellular wireless Internet access system.

9. The method of any preceding claim wherein the system is a UMTS system.

10. A wireless access network system comprising:
a RADIUS arrangement with an associated RADIUS accounting function, the RADIUS arrangement being arranged to track access activity by a user accessing the network via wireless user equipment and via the RADIUS arrangement, and to record such activity in an accounting database associated with the RADIUS accounting function.

11. The system of claim 10 wherein the RADIUS arrangement tracks the user's connection time.

12. The system of claim 10 or 11 wherein the RADIUS arrangement tracks the user's volume of data transmitted.

13. The system of any one of claims 10-12, wherein the accounting database is arranged to be updated upon user disconnection.

14. The system of any one of claims 10-13, wherein the accounting database is arranged to be updated at predetermined intervals of time to thereby accommodate long duration connection sessions.

15. The system of any one of claims 10-14, wherein the RADIUS arrangement is arranged to receive information from a network controller of the system.

16. The system of claim 15 wherein the RADIUS arrangement comprises a RADIUS client at the network controller.

17. The system of any one of claims 10-16, wherein the system is a cellular wireless Internet access system.

18. The system of any one of claims 10-17, wherein the system is a UMTS system.

19. A RADIUS arrangement for use in a wireless access network system, comprising:

a RADIUS server;

an associated RADIUS accounting function; and

the RADIUS server being arranged to track access activity by a user accessing the network via wireless user equipment and via the RADIUS server, and to record such activity in an accounting database associated with the RADIUS accounting function.

20. The RADIUS arrangement of claim 19 further comprising a RADIUS client provided at a network controller of the system.

21. A network controller for use in a wireless access network system, the network controller having a RADIUS

client for use with a RADIUS server in accounting of user access to the network.

22. A computer program element comprising computer program means for performing the method of operation in a wireless access network system as claimed in any one of claims 1 to 9.

23. A method of operating a cellular wireless Internet access system using RADIUS (Remote Authentication Dial-In User Service) which is normally used with a PSTN (Public Switched Telephone Network) where the user utilizes a portable subscriber terminal with a directly attached antenna for communicating in a wireless manner via a cellular network with an integrated network controller and then to a target Internet Service Provider (ISP), comprising the following steps:

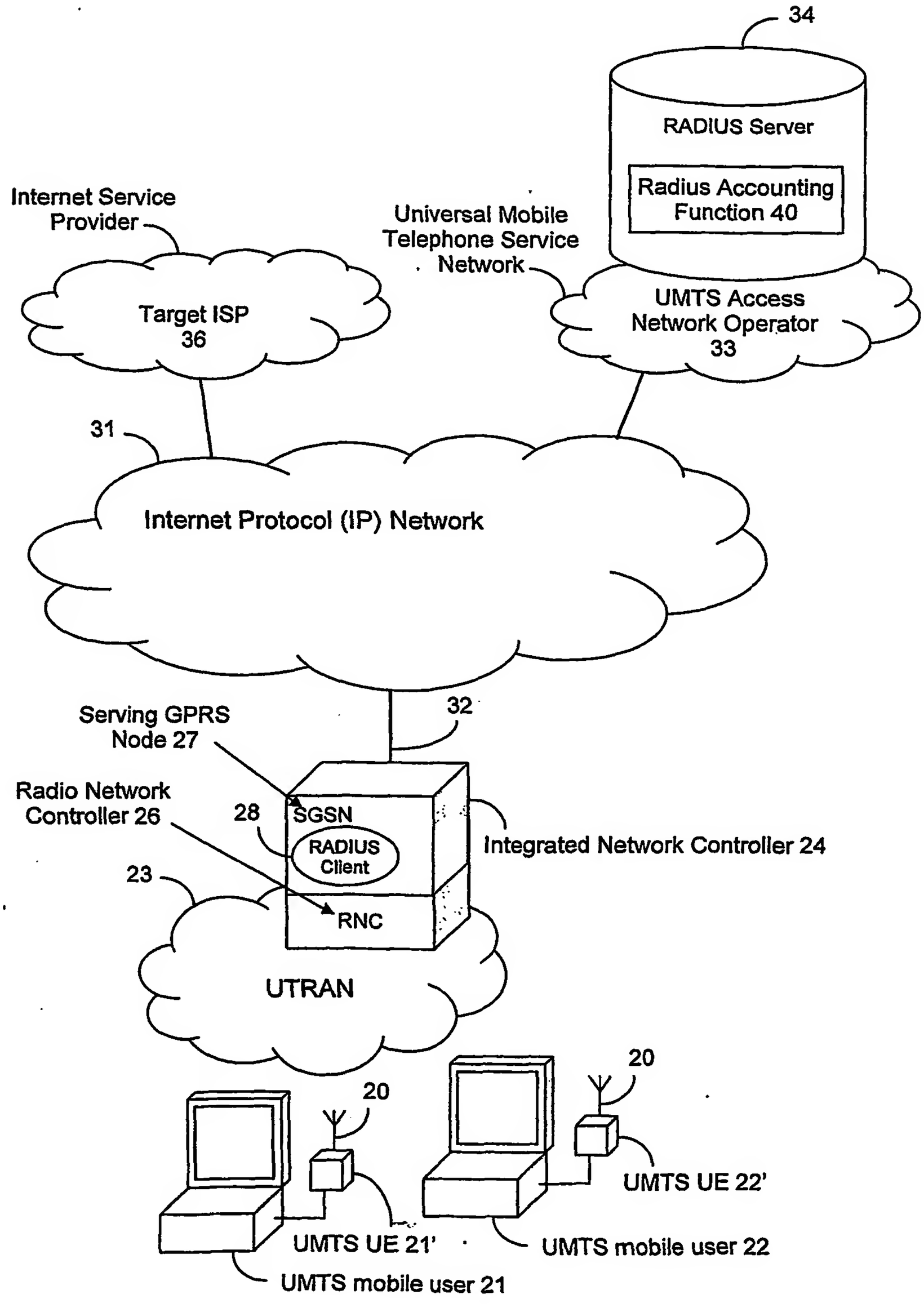
in conjunction with a wireless access network operator providing a RADIUS server and associated RADIUS accounting function;

providing a subscriber terminal with a link via a cellular wireless network and an Integrated Network Controller for negotiating access to said RADIUS server;

if access is approved by said RADIUS server, tracking by the RADIUS accounting function, the connect time for said subscriber terminal to a said wireless Internet access system and keeping records of volume of data transmitted and a record of connection time of the subscriber terminal in an accounting database connected with said RADIUS server, disconnection occurring when the subscriber terminal disconnects from said ISP.

24. A method as in claim 23 where accounting requests are sent from the integrated network controller to said RADIUS server at predetermined intervals of time to thereby accommodate long duration Internet connection sessions.

FIG. 1


34
RADIUS Server
Radius Accounting Function 40
Internet Service Provider
Universal Mobile Telephone Service Network
Target ISP 36
UMTS Access Network Operator 33
31
Internet Protocol (IP) Network
32
Serving GPRS Node 27
Radio Network Controller 26
28
SGSN
RADIUS Client
Integrated Network Controller 24
23
RNC
UTRAN
20
20
UMTS UE 22'
UMTS UE 21'
UMTS mobile user 22
UMTS mobile user 21

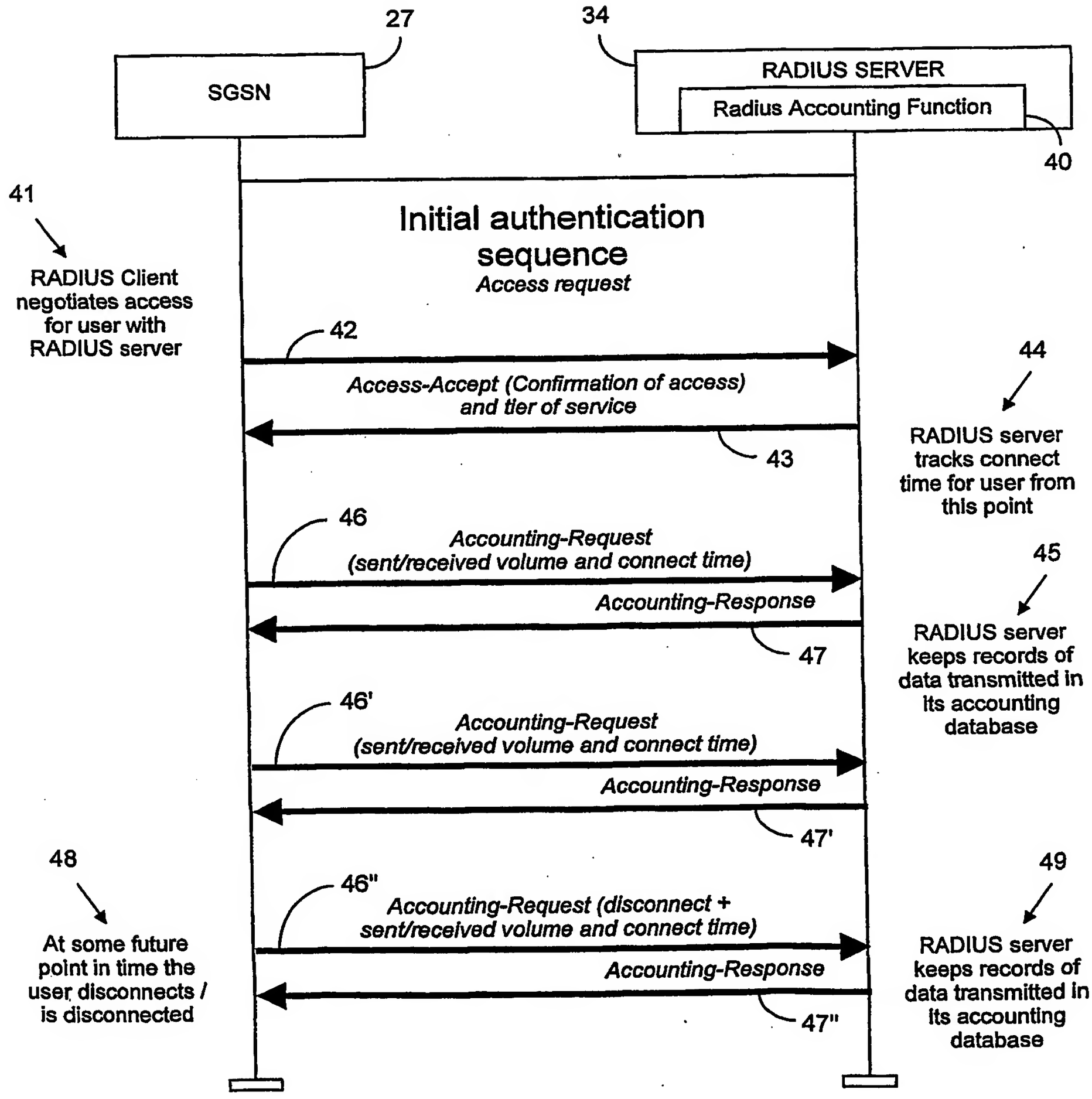

27
SGSN
34
RADIUS SERVER
Radius Accounting Function
40
41
RADIUS Client negotiates access for user with RADIUS server
Initial authentication sequence
Access request
42
Access-Accept (Confirmation of access) and tier of service
43
44
RADIUS server tracks connect time for user from this point
46
Accounting-Request (sent/received volume and connect time)
Accounting-Response
47
45
RADIUS server keeps records of data transmitted in its accounting database
46'
Accounting-Request (sent/received volume and connect time)
Accounting-Response
47'
48
At some future point in time the user disconnects / is disconnected
46"
Accounting-Request (disconnect + sent/received volume and connect time)
Accounting-Response
47"
49
RADIUS server keeps records of data transmitted in its accounting database

FIG. 2